ALIGNING CONTENT IN AN ELECTRONIC DOCUMENT

FIELD OF THE INVENTION

The present invention relates to aligning objects in electronic document pages and more specifically to a method for aligning the content of one object relative to the content of another object.

BACKGROUND OF THE INVENTION

Electronic document editors are widely used in homes and businesses today. Familiar examples of these editors include word processing applications that operate on personal computers (PCs) and note-taking applications that operate on personal data assistants (PDAs). One goal for these applications is to replace paper as the simplest means to record and communicate information. However, to replace and enhance paper's utility, the electronic document editor should allow the user to place document objects on a page and to edit, move, resize, and add text and other content, while ensuring that the user can efficiently review the page, clearly scan the individual objects, and readily read the content of each object. Also, unlike typical word processors, a free-form document editor that allows a user to quickly absorb content from multiple objects more closely models paper's utility.

One function that a free-form electronic document editor should have to enhance its utility is the capability to align document objects relative to one another to present a user with an organized view of textual and graphic content. When content on a page is organized and aligned, a user can quickly scan the page to identify information of interest.

A typical word processor presents text in an organized, one-dimensional format. Text is usually entered onto a page beginning at the top left-hand corner and moving in a line, more or less continuously, to the lower right-hand corner of the page. Although this format promotes legibility, it imposes a rigid structure upon the

user. Many users find this structural imposition more limiting, and thus less desirable, than traditional pen and paper.

In contrast, a free-form document editor supports document objects, islands of content that can be added anywhere on the two dimensional surface of the page. A document object contains textual and/or graphic content that is grouped together. This content may include text entered by a keyboard or similar device, handwriting entered with a stylus or similar device, a drawing, or a combination of these items. However, if an electronic document contains multiple islands of content and the content of each island is misaligned, then readability can suffer. Consequently, islands of content in an electronic document need to be aligned relative to one another to facilitate a user readily scanning the page to identify information contained therein.

Some word processing programs allow users to place text boxes on a page. A text box is a type of document object that contains textual content presented in the format of a rectangular box or other geometric shape. An electronic document may display textual content inside a rectangular frame so that the text box serves as a content container. However, conventional word processing programs do not generally support automatically arranging these boxes or their content relative to one another so that the content of multiple boxes is uniformly aligned.

A user typically creates a new text box by positioning a pointer, such as a cursor or stylus, at a desired position on the electronic page and entering an insertion point ("IP"). The location of the IP defines the starting point of the content that the user enters. If the user precisely positions the IP, the content of the new text box may be aligned with the content of an existing text box. More commonly, the content in multiple text boxes is not precisely aligned since such manual alignment is tedious. Furthermore, conventional word processing programs generally lack a provision to automatically align a new IP with an existing text box. An electronic page that displays text boxes with misaligned content does not generally promote readership.

One of the advantages of traditional pen and paper is the ease with which information can be rearranged and presented. A user can jot down islands of content at convenient locations on the top sheet of a pad of paper whenever the need arises to record information. The user can then tear off the top sheet and manually transfer the
5 content to a new sheet at a convenient time. The user can arrange the islands during the transfer process so that the content of each island is presented in relative alignment. Users sometimes arrange the overall layout of a page to emphasize specific content, for example placing a dominant island of content in the upper left corner of the page. In a presentation format that features aligned content, the user can
10 quickly scan the sheet to reference information. However, many users find manually transferring information between sheets undesirable. Many users also find manually reorganizing information in electronic documents, which typically offer limited screen space for clearly displaying information, cumbersome. Furthermore, conventional electronic document editors generally lack capabilities to automatically
15 arrange the content of multiple test islands.

What is needed is a capability for automatically positioning one or more document objects in an electronic document so the contents of multiple objects are aligned relative to one another. This capability should also include automatically aligning an IP relative to the content of an existing document object. Such a
20 capability would combine the flexibility of pen and paper with the readability of word processing documents.

SUMMARY OF THE INVENTION

The present invention can provide a computer-implemented method for
25 aligning content on an electronic page. When a user selects a location on an electronic page as the insertion point ("IP") for entering new content, the present invention can adjust the position of the IP so that the new content is aligned with existing content. The method can include adjusting the IP after the user selects the IP

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position but before the user enters the new content. The method can also include adjusting the IP after the user enters the new content.

In one aspect of the present invention, a computer-implemented method for aligning content on an electronic page includes organizing the electronic page so that the contents of multiple document objects are aligned with respect to one another. The method can include moving specific contents of one or more document objects.

In another aspect of the present invention, a computer-implemented method for aligning content on an electronic page can include creating guidelines and associating them with content features that are relevant to alignment. Guidelines provide alignment guides that facilitate aligning the content of one document object in relation to the content of another document object. The method can include attaching or otherwise aligning vertical guidelines to text features such as a tab stop, a margin, a reflow bar, or other formatting feature. The method can also include attaching or otherwise aligning horizontal guidelines to text features such as a center of a line, a paragraph separator, or title block. When a document object's position on the page changes, guidelines associated with the content of the document object can move along with the document object.

A guideline can include a gravity parameter that defines a distance beyond which the guideline does not influence the placement of a document object or its content. A guideline can either span the entirety of the page or a portion thereof. If content is located beyond the length of a fixed-length guideline, the method can include suppressing the guideline's influence on placement of that content. The method can also include establishing a hierarchy between guidelines to facilitate preferentially aligning content with respect to one guideline rather than another.

In yet another aspect of the present invention, a computer-implemented method for aligning content on an electronic page can include organizing a page of multiple existing document objects by arranging the contents of each document object in relation to one or more other document objects on the page. The method can also

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include establishing a hierarchy between document objects to facilitate preferentially aligning content with respect to one object over another and/or with respect to one area of the page over another.

The discussion of aligning content presented in this summary is for illustrative purposes only. Various aspects of the present invention may be more clearly understood and appreciated from a review of the following detailed description of the disclosed embodiments and by reference to the drawings and claims.

BRIEF DESCRIPTION OF THE DRAWINGS

Figure 1 is a functional block diagram illustrating a representative operating environment for an exemplary embodiment of the present invention.

Figure 2 is a functional block diagram illustrating primary functional components of an exemplary electronic document editor and related input devices for an exemplary embodiment of the present invention.

Figure 3 is a display image of an electronic page illustrating an IP and a document object with guidelines, where the object includes textual content and the guidelines are aligned to features of the textual content in accordance with an exemplary embodiment of the present invention.

Figure 4 is a display image of an electronic page illustrating two document objects with guidelines and further illustrating content alignment between the objects in accordance with an exemplary embodiment of the present invention.

Figure 5 is a display image of an electronic page illustrating a graphical document object surrounded by a selection box and a text box with guidelines that facilitate content-to-graphic alignment in accordance with an exemplary embodiment of the present invention.

Figure 6 is a flow diagram illustrating a process for inserting a document object into an electronic page by aligning an IP to a guideline of an existing object in accordance with an exemplary embodiment of the present invention.

Figure 7A is a display image illustrating an electronic page with several document objects that have misaligned contents with respect to one another prior to alignment in accordance with an exemplary embodiment of the present invention.

Figure 7B is a display image illustrating the electronic document of Figure 7A following content alignment for the document objects in accordance with an exemplary embodiment of the present invention.

Figure 8 is a flow diagram illustrating a process for aligning the content of document objects in an electronic document with respect to one another in accordance with an exemplary embodiment of the present invention.

DETAILED DESCRIPTION OF THE EXEMPLARY EMBODIMENTS

Exemplary embodiments of the present invention support aligning the contents of objects, such as the textual contents of document objects, in an electronic document page. Guidelines that emanate from features of the content of a document object support positioning the content of one object into relative alignment with the content of another object. Turning now to the drawings, in which like numerals indicate like elements throughout the several figures, a preferred exemplary embodiment of the invention will be described in detail.

Exemplary Operating Environment, Figures 1 – 2

Figure 1 illustrates a representative operating environment **100** for an exemplary embodiment of the present invention. This representative operating environment includes a general-purpose computing device in the form of a conventional personal computer **101**. Generally, the personal computer **101** includes a processing unit **120**, a system memory **104**, and a system bus **102** that couples system components including the system memory **104** to the processing unit **120**. The system bus **102** may be any of several types of bus structures including a memory bus or memory controller, a peripheral bus, and a local bus using any bus

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architecture. The system memory includes a read-only memory (ROM) **106** and a random access memory (RAM) **110**. A basic input/output system (BIOS) **108**, containing the basic routines that help to transfer information between elements within the personal computer **101**, such as during start-up, is stored in ROM **106**.

5   The personal computer **101** further includes a hard disk drive **128**, a floppy disk drive **132** for reading from or writing to a removable magnetic disk **134**, and an optical disk drive **138** for reading from or writing to a removable optical disk **140** such as a CD-ROM or other optical media. A hard disk drive **128**, a magnetic disk drive **132**, and an optical disk drive **138** are connected to a system bus **102** by a hard

10   disk drive interface **120**, a floppy disk drive interface **130**, and a CD-ROM disk drive interface **136**, respectively. Although the exemplary environment described herein employs a hard disk **128**, a removable magnetic disk **134**, and a removable optical disk **140**, it should be appreciated by those skilled in the art that other types of computer readable media that can store data that is accessible by a computer, such as

15   magnetic cassettes, flash memory cards, digital video disks, Bernoulli cartridges, RAMs, ROMs, and the like, may also be used in the exemplary operating environment. The drives and their associated computer-readable media provide nonvolatile storage of computer-executable instructions, data structures, program modules, and other data for the personal computer **101**.

20   A number of program modules may be stored on the hard disk **128**, the magnetic disk **134**, the optical disk **140**, the ROM **106**, or the RAM **110**, including an operating system **112**, an electronic document editor **114**, and multiple application programs **116 – 118**. Program modules typically include routines, sub-routines, programs, objects, components, data structures, etc., that perform particular tasks or

25   implement particular abstract data types.

A user may enter commands and information into the personal computer **101** through input devices, such as a keyboard **146** and a pointing device, such as a mouse **144**. Pointing devices may also include a trackball (not shown) and an electronic pen

or stylus (not shown) that can be used in conjunction with an electronic tablet or a typical display screen. Other input devices (all not shown) may include a microphone, joystick, game pad, satellite dish, scanner, or the like. These and other input devices are often connected to a processing unit **120** through a serial port

5   interface **142** that is coupled to the system bus **102**, but may be connected by other interfaces, such as a parallel port, game port, a universal serial bus (USB), or the like. A display device, such as a monitor **124**, may also be connected to the system bus **102** via an interface, such as a video adapter **122**. In addition to the monitor, personal computers typically include other peripheral output devices (not shown), such as

10   speakers and printers.

The personal computer **101** may operate in a networked environment using logical connections to one or more remote computers **154**. A remote computer **154** may be another personal computer, a server, a client, a router, a network PC, a peer device, or other common network node. While a remote computer **154** typically

15   includes many or all of the elements described above relative to the personal computer **101**, Figure 1 only illustrates a memory storage device **156**. The memory storage device **156** may include Application Program A **158** and Application Program B **160**. The logical connections depicted in Figure 1 include a local area network (LAN) **152** and a wide area network (WAN) **162**. Such networking environments are

20   commonplace in offices, enterprise-wide computer networks, intranets, and the Internet.

When used in a LAN networking environment, the personal computer **101** is often connected to the local area network **152** through a network interface or adapter **150**. When used in a WAN networking environment, the personal computer **101**

25   typically includes a modem **148** or other means for establishing communications over WAN **162**, such as the Internet. Modem **148**, which may be internal or external, is connected to the system bus **102** via a serial port interface **142**. It will be appreciated

that the network connections shown are exemplary and other means of establishing a communications link between the computers may be used.

Moreover, those skilled in the art will appreciate that the present invention may be implemented in other computer system configurations, including PDAs,

5 electronic writing tablets, multiprocessor systems, microprocessor based or programmable consumer electronics, network personal computers, minicomputers, mainframe computers, and the like. The invention may also be practiced in distributed computing environments, where tasks are performed by remote processing devices that are linked through a communications network. In a distributed

10 computing environment, program modules may be located in both local and remote memory storage devices.

Figure 2 is a block diagram depicting the primary functional components of an exemplary electronic document editor and related input devices for the representative operating environment of an electronic writing tablet, otherwise described as an

15 electronic tablet. Specifically, Figure 2 depicts an architecture **200** for an electronic writing tablet in the context of an electronic document editor constructed in accordance with an exemplary embodiment of the present invention. Conventional input devices are represented by the keyboard **260** and the pointing device **265** (*e.g.*, mouse, trackball). Other output devices (not shown) can include a printer or speaker.

20 Other hardware components shown in Figure 2 include an electronic tablet **250** and an accompanying stylus **255**. The tablet **250** and stylus **255** are used to input handwriting strokes that can be converted to data, referred to as electronic ink. The electronic ink may be incorporated into an electronic document **220** and may be displayed on either the electronic tablet **250**, the monitor **270**, or both. Although the

25 electronic tablet **250** and the monitor **270** are illustrated as being distinct, in an exemplary embodiment of the present invention, they can be integrated into a single component. The joint tablet/monitor component has the ability to display information and receive input from the stylus **255**.

In the representative architecture **200**, an ink-processing module **225** is operable to receive data from the electronic tablet **250** and to render that data as electronic ink. In one embodiment of the present invention, the ink-processing module **225** can be a collection of software modules that perform different tasks for

5   rendering handwriting strokes as electronic ink. For example, the stylus and ink module **228** can receive data describing the positions and angles of the stylus for a series of handwriting strokes. The stylus and ink module **228** can interpret the data for rendering electronic ink. Other software modules, such as a gesture recognizer **230** and word recognizer **235** can be designed to identify certain handwriting strokes

10   and assign them a particular significance. For example, certain gestures such as a cross-out may be recognized and associated with other editing processes. The ink-processing module **225** can also include an erasing functions module **240** for removing electronic ink that has been previously rendered.

Although ink processing modules are known in the art and necessary for an

15   electronic tablet to function, a novel document editing module has been developed by Microsoft Corporation of Redmond, Washington that capitalizes on the benefits of handwriting processing technology. The module (i.e., document editor) is a free-form document editor that leverages the functionality of electronic handwriting technology to enable more effective and efficient note taking. Specifically, document editing

20   module **114** facilitates manipulating electronic ink so that a user can create and modify an electronic document **220** with greater ease and sophistication. The document editing module **114** typically comprises a collection of software modules for controlling and manipulating electronic ink rendered on the monitor **270**. For example, a parsing module **210** can be used to identify handwriting strokes that are

25   selected by the user for editing. Selected strokes may by highlighted or shaded to assist the user in identifying which strokes are to be edited. A classifier module **215** can identify certain handwriting strokes as being part of a word or drawing and may designate document objects accordingly. Also, the document editing module **114** can

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seamlessly integrate ink processing, performed by the ink processing module **225**, with text processing, performed by a text processing module **226**. The text processing module **226** can receive input from the keyboard **260** or a microphone coupled with a voice recognition software program (not shown) or other input device. This seamless integration allows a user a variety of ways to create and edit document objects using the electronic document editor **114** (Figure 1) and multiple input devices may be used to create or edit a single document object.

A membrane module **207** can create a membrane, also referred to herein as a container, around a document object, delineating the boundary of the document object to support editing the document object. The membrane may be a set geometric shape, such as a rectangle around the entire content of the document object, or may mimic the contours of one or more sides of the document object contents. The interior of the membrane shape may be shaded a contrasting color compared to the background color of the document page and the colors of the document object contents. For example, the interior of a membrane shape may be shaded light gray while a page area may be white and the contents may be black. The shading color may be changed, either automatically by the membrane module **207** or a user, possibly by selecting options from a menu, to enhance the contrast between the document page background, the membrane, and the document object contents. In an alternative embodiment, a membrane may be indicated through a haptic device, in other words, a device that provides tactile responses. The membrane module **207** may indicate which document objects are currently being acted upon by a user by displaying a membrane around that document object or by displaying some other indicator, such as one or more handles on a continually-displayed membrane. Also, the membrane module **207** may create a ghost membrane when an IP is placed on a document page outside an existing document object boundary. This ghost membrane may have a fixed size, shape, and shading. These characteristics may be fixed within the membrane module **207** or, established by the membrane module **207** through a user

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selecting characteristics for the ghost membrane, such as by selecting items from a menu.

A guideline module **208** can create guidelines that emanate from content features within a document object and serve as floating positional references for the placement of other content on the electronic page. The guidelines adhere to features of the content in a document object, so that if the document object is repositioned on the page, the guidelines follow the document object's movement. Guidelines differ in this respect to a document grid, which is a coordinate system that is fixed to the document, in similar fashion to the writing lines on a sheet of traditional paper.

The guideline module **208** can, for example, establish horizontal guidelines that are fixed to text lines or vertical guidelines that are fixed to tab settings. When multiple guidelines emanate from a single document object, the guideline module **208** can apply rules to the situation to determine the relevance of each guideline for positioning new content. The guideline module **208** can also determine a guideline hierarchy so that content can be positioned according to the guidelines of one document object rather than the guidelines of a less-dominant document object.

Exemplary embodiments of the present invention relate most directly to bringing the contents of multiple document objects into relative alignment with one another. Figures 1 and 2 provide a general overview of the environments in which the present invention's use is contemplated.

Exemplary Electronic Pages, Figures 3 – 5

Figure 3 is a display image that depicts an electronic document **300** presenting an existing document object **310** and a new IP **320**. This figure illustrates a typical situation in which a user has previously entered an island of content **310** into an electronic document **300** and is now initiating the process of entering a new island of content at the IP **320**. As will be described below, the present invention can

automatically adjust the IP **320** so that when the user enters new content onto the page **300** the new content is automatically aligned with existing content.

The document object **310** is positioned at an arbitrary location on the page **300**. This position could be described in terms of an absolute coordinate system (not shown) of the page **300** that is often referred to as a "grid." Independent of a grid coordinate system, the present invention can use guidelines to reference the placement of new content on the page **300** to the position of the existing document object **310**. Figure 3 depicts Guidelines **330 – 350** emanating from Document Object **310** that facilitate the placement of new content on the page **300** in relation to the content of Document Object **310**. The guidelines **330 – 350** are attached to the content of the document object **310** so that if a user relocates the document object **310** on the page **300**, the guidelines **330 – 350** move along with the document object **310**.

The guidelines **330 – 350** are vertical and horizontal reference lines that intersect with features of the content that are pertinent to alignment. Horizontal guidelines **330**, which are aligned to the lines of text that make up the contents of the document object **310**, provide a spatial reference for the vertical placement of other content on the page **300** in relation to that text. Measuring the shortest distance between Guideline **331** and Graphic Element **352** on the page **300**, for example, yields the vertical offset between that element **352** and the first line of text in the document object **310**. Since Guideline **331** is attached to the content of the document object **310**, the guideline **331** moves and the offset changes if the document object **310** moves but the graphic element **352** remains stationary. The offset also changes if the graphic element **352** moves but the document object **310** remains stationary. Similarly, the offset remains constant if the document object **310** and the graphic element **352** move in unison.

Although depicted in Figure 3 as tracing the bottom of a line of text, horizontal guidelines **330** can provide a reference to a variety of textual and graphic features. For example, a horizontal guideline can be aligned to the center point of a

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graphic image that is embedded in text or otherwise part of a document object's content. One or more horizontal guidelines can provide a reference to the top of a table that is content in a document object **310**. A horizontal guideline can delineate the title bock from the body of a text box that is displayed in an electronic document

5   page **300**. A horizontal guideline can indicate the position between two paragraphs or between two sections of content in a document object **310** that contains a body of textual content. A horizontal guideline can be collinear with the 'total sum' line in a spreadsheet of financial data.

In addition to horizontal guidelines **340 – 342**, Figure 3 illustrates vertical

10   guidelines **340, 341, 342, 350** that are attached to content features in the document object **310**. Guideline **340** traces the left-most text location, or left-hand margin, in the document object. In other words, if a user selected the document object **310** and began entering a string of text using a left-justified format, the first letter in the string would be aligned to Guideline **340**. Guideline **341** traces the position of the first tab

15   stop, or line indentation, in the content of document object **310**. Similarly, Guideline **342** indicates the position of the second tab stop in the content of document object **310**.

Guideline **350** is aligned to the reflow bar of the text content in the document object **310**. If a user enters a character into a text line of the text block on the left side

20   of Guideline **350**, the character remains on that text line. However, if a user enters a character that crosses Guideline **350** from left to right, then the entered character reflows to the next line. Guideline **350** can also indicate the position of text alignment for text in a right-justified format.

Like horizontal guidelines, vertical guidelines can provide a reference to a

25   variety of textual, numeric, and graphical content features. For example, a vertical guideline can delineate between two columns of content. For document objects that present lists of financial numbers, a vertical guideline can indicate the position of a decimal point or a dollar sign in the list.

Vertical guidelines **340 – 350** facilitate the determination of a horizontal displacement between a content feature and another element on the page **300**. For example, measuring the shortest distance between a tab guideline **341** and Graphic Element **355** on the page **300** yields the horizontal displacement between the tab and the graphic element **355**.

Although Figure 3 depicts the guidelines **330 – 350** as solid lines, in an exemplary embodiment of the present invention, the guidelines **330 – 350** are not visible on the electronic page **300** to a user. In one embodiment of the present invention, the guidelines **330 – 350** are present on the page **300** but not visible. In one embodiment of the present invention, each guideline **330 – 350** is an equation of a line that is coded in software.

In an exemplary embodiment of the present invention as illustrated in Figure 3, each guideline **330 – 350** has a fixed length. If an element is positioned on a page **300** beyond the length of a fixed-length guideline **330 – 350**, then the element is outside the measurement bounds of that guideline **330 – 350**. Thus, the length of a fixed-length guideline **330 – 350** is useful to define a measurement region surrounding a document object **310**. Inside the region, displacement of an element relative to a content feature is relevant to the organization of content on the page **300**. Outside the region, displacement of an element relative to a content feature is less important to the organization of content on the page **300**. For example, Guideline **341** facilitates a measurement of the horizontal displacement between Graphic Element **355** and the first tab stop in the content of the document object **310**. In contrast, Graphic Element **360** is outside of Guideline **341**'s measurement boundary.

In an alternate exemplary embodiment of the present invention, each horizontal guideline **330** spans the full width of the document page **300**, and each vertical guideline **340 – 350** spans the full height of the document page **300**. A full-page guideline (not shown) provides a displacement measurement between a feature of a document object **310** and another element on the page **300** regardless of the

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distance between the document object **310** and the other element. In other words, the measurement boundary of a full-page guideline can encompass the entirety of the page **300**. If Guideline **341** was a full-page guideline, then it would facilitate horizontal displacement measurements of both Graphic Element **350** and Graphic

5   Element **360** relative to the first tab stop.

For both full-page guidelines and fixed-length guidelines **330** – **350**, the specifications for each guideline **330** – **350**, can include a gravity distance. Gravity distance is the distance over which a guideline is relevant to the alignment of content. For example, the gravity of Guideline **342** might not extend to Graphic Element **365**,

10   which is positioned on the opposite side of the page **300**. In one embodiment of the present invention, gravity is a preset system parameter. In another embodiment of the present invention, a user sets gravity according to user preference and application needs. In yet another embodiment of the present invention, gravity is set as a fraction of page width.

15   The electronic page presented in Figure 3 includes an IP **320** through which a user enters content into the page **300**. Using a pointer, such as a stylus **255** or a pointing device **265**, the user indicates to the computer system **200** a location on the page **300** for content entry. After indicating the IP **320**, the user can begin entering content.

20   If a user selects an IP **320** without precisely aligning the IP **320** to the content of the existing document object **310** and begins entering content at that spatial location **320** on the page **300**, then the new content will be misaligned with the content of the existing document object **310**. The present invention can avoid this misalignment condition, which is usually undesirable, by automatically adjusting the

25   IP **320** so that the new content is aligned to the existing content.

If a user selects an IP at Position **320** as illustrated in Figure 3, then the present invention can shift the IP to Position **380** so that the new content is aligned to the existing content in the existing document object **310**. In one embodiment of the

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present invention, the IP **320** shifts into alignment **380** after the user selects the IP position but before the IP appears on the page **300**. In other words, if a user selects an IP position **320** that will result in content that is out of alignment with preexisting content **310**, then a computer-implemented process moves the IP **320** into a position

5   of alignment **380** and displays the aligned IP **380** on the electronic page **300**. In another embodiment of the present invention, the IP **320** shifts into alignment after the user enters the new content. In other words, if a user selects a misaligned IP position **320** and enters new content from the misaligned IP position **320**, then a software-based process moves the IP **320** into a position of alignment **380** after the

10   user completes entering the new content. The newly-entered content follows the IP movement and thus snaps into alignment with the content of the preexisting document object **310**. In yet another embodiment of the present invention, when a user selects an IP position **320** that is out of alignment, the electronic page displays both the misaligned IP **320** and the aligned IP **380**, so that the user can choose to enter content

15   from either IP **320, 380**.

An exemplary process for implementing this positional adjustment can include measuring the displacement between IP **320** and Guideline **331** and moving IP **320** to Position **380** so that the shifted IP **380** is aligned with Guideline **331**. Figure 6, which is described below, illustrates a flow chart for an exemplary

20   adjustment process.

Whereas Figure 3 illustrates an electronic page with a text-based document object **310** and an IP **320**, Figure 4 illustrates an electronic page **400** with two document objects, one of which has textual content embedded in an exemplary graphic.

25   The left document object **405** depicted in Figure 4 is a graphical representation **408** of a computer storage device with textual content **410**. Horizontal guidelines **430** trace each line of content while Guideline **431** and Guideline **432** specifically trace the first and second lines of content respectively. Vertical

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Guidelines **440**, **441**, and **442** indicate the margin, first tab stop, and second tab stop respectively. The right document object **310** is a reproduction of the exemplary document object **310** that is illustrated in Figure 3 with similar vertical and horizontal guidelines **330 – 340**.

5   Figure 4 illustrates an exemplary scenario in which a user enters inserts a graphic document object **405** and its content **410** at an arbitrary position on the electronic page **400**. After this entry, the user enters a second, non-graphic document object **310** at a misaligned position on the electronic page **400**. The user inserted the second document object **310** into the page **400** by "cutting" the object from another

10   page (not shown) and inserting it into the illustrated page **400**, for example.

Figure 4 further illustrates a capability of the present invention to align the content **310** of a newly-entered document object **310** relative to the content **410** of a previously-entered document object **405**. The present invention can adjust the position of the non-graphic document object **310** so that its content is aligned to the

15   content **410** of the other document object **405**, which the user previously inserted. The horizontal guidelines **330**, **430** of the document objects **405**, **310** facilitate measuring vertical misalignment, which corresponds to the adjustment distance that is needed to bring the content into relative alignment. A computer-implemented process moves the non-graphic document object **310** vertically, as indicated by the arrows

20   **460**, until Guideline **431** overlays Guideline **332**.

In one embodiment of the present invention, software in the document editing module **114**, which is illustrated in Figures 1 and 2, aligns each line of content separately to provide line-to-line alignment for text blocks with slightly different line heights. For example, the contents of the graphic document object **405** and the non-

25   graphic document object **300** could be formatted with 1.25 line spacing and 1.35 line spacing respectively. For this situation, the present invention can adjust the vertical position of the first line of content in the non-graphic document object **310** until Guideline **332** overlays Guideline **431**. Similarly adjusting the second line of content

until Guideline **331** overlays Guideline **432** aligns the second line of content in both document objects **405, 310**. Separately adjusting each line of textual content brings the full content of both document objects into alignment.

Figure 5 illustrates the application of guidelines in a graphic-orientated electronic page **500** in accordance with an exemplary embodiment of the present invention. The electronic page **500** includes a document object **510** that contains a graphical illustration **520** of a device and a document object **570** that contains textual content **575, 580** that describes specific features of the device. The figure also presents guidelines **560, 565, 593, 596** that facilitate alignment between the device features and the content **575, 580**.

A graphical representation **520** of a flat-panel computer display terminal is surrounded by a larger selection box **530** with protruding manipulation handles **540**. A vertical guideline **550** marks the center of the flat-panel display, which is offset from the center of the selection box **530** and the manipulation handles **540**. Guideline **560** and Guideline **565** respectively mark the top of the flat-panel display and its base. The illustrated guidelines **550, 560, 565** that are associated with the flat-panel display document object **510** are independent of the selection box **530** and the manipulation handles **540**. Consequently, the guidelines **550, 560, 565** facilitate alignment of content on the page **500** to features of flat-panel display irrespective of the selection box **530** or the manipulation handles **540**.

A text-oriented document object **570** contains two smaller document objects, each of which holds content that describes a specific feature of the flat-panel display **520**. One of the two smaller document objects **575** is a block of textual and graphic content related to the top of the flat-panel display **520**. The content describes the top of the display, and an embedded arrow **578** serves to point out the specific device feature. Guideline **593** traces the center of the first line of textual content and the center of the embedded arrow **578**. As illustrated, the text block **575** and its embedded arrow **578** are misaligned with the top of the flat-panel display. To align

the content **575** and the arrow **578** to the top of the flat panel display, the present invention moves the content of the small document object **575** vertically until Guideline **593** overlays Guideline **560**.

The other smaller document object **580** includes a block of textual content related to the base of the flat-panel display **520**. Guideline **596** indicates the centerline of the first line of content in Document Object **580**. As illustrated, the textual content **580** is misaligned with the device feature to which it refers. To bring it into alignment, the present invention moves the content of Document Object **580** vertically until Guideline **596** overlays Guideline **565**.

Figure 5 also illustrates a vertical guideline **583** associated with the group of product-feature document objects **570**, **580**, **575**. Guideline **583** facilitates the alignment of the content of Document Object **575** in relation to Document Object **580**, which are illustrated in an aligned state. Guideline **583** also facilitates the alignment of Document Object **575** and Document Object **580** within Document Object **570**. In other words, Guideline **583** represents a left text margin for Document Object **575**, a left text margin for Document Object **580**, and/or a text alignment guideline for Document Object **570**.

Exemplary Process for Aligning Content, Figure 6

Figure 6 is a flow diagram illustrating a process **600** for inserting a document object into an electronic document by aligning an IP to a guideline of an existing object in accordance with an exemplary embodiment of the present invention. Process **600** is an exemplary process for implementing the alignment illustrated in Figure 3 and described above.

The present invention can include multiple computer programs which embody the functions and/or implement the steps described herein according to the exemplary flow charts. However, it should be apparent that there could be many different ways of implementing the invention in computer programming, and the invention should

not be construed as limited to any one set of computer program instructions. Further, a skilled programmer would be able to write such a computer program to implement the disclosed invention without difficulty based on the exemplary flow charts and screen displays and associated description in the application text, for example.

5   Therefore, disclosure of a particular set of program code instructions is not considered necessary for an adequate understanding of how to make and use the invention. The inventive functionality of the claimed computer program will be explained in more detail in the following description in conjunction with the remaining figures illustrating the functions and program flow.

10   Certain steps in the processes described must naturally precede others for the present invention to function as described. However, the present invention is not limited to the order of the steps described if such order or sequence does not alter the functionality of the present invention. That is, it is recognized that some steps may be performed before or after other steps or in parallel with other steps without departing
15   from the scope and spirit of the present invention.

Referring now to Figure 3 and Figure 6, at Step **605**, a user selects an electronic page **300** for editing. At Step **610**, the document editing module **114** responds to the user and opens an electronic page **300** that may or may not contain an existing document object **310**. At Step **615**, the user selects a location **320** on the
20   page **300** as the insertion point for entering content. The user may implement this selection by placing a pointing device **265**, such as a mouse or a stylus, anywhere on the two-dimensional surface of the page **300** while viewing a user display such as a monitor **270** or a tablet **250**.

At Step **620**, the document editing module **114** determines if the page **300**
25   contains one or more existing document objects **310**. If the page **300** contains existing document objects **310**, the document editing module **114** can adjust the IP **320** to align new content with existing content **310**, as discussed below. If the page **300** does not contain any existing document objects **310**, then at Step **630**, the

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document editing module **114** retains the location of the IP **320** that the user selected in Step **615**. At Step **640**, the user enters content and the document editing module **114** inserts the content into the electronic page based on the IP **320**. In other words, if a user selects a content-entry location **320** of a blank electronic page **300**, then the document editing module **114** places the user's content at that location **320**.

After the user enters content into the electronic page **300**, Sub-process Create Guidelines **650**, which is a routine in the guideline module **208** illustrated in Figure 2, creates guidelines aligned to features of the new content. In one embodiment of the present invention, the guidelines are vertical and horizontal guidelines aligned with formatting features of the new textual content.

If the user selects an insertion point location in an electronic page **300** that contains an existing document object **310**, then the document editing module **114** adjusts the IP **320** following Steps 655 – 680. At Step **655**, the document editing module **114** determines if the IP **320** is within the gravity and measurement boundary of at least one guideline. In one embodiment of the present invention, the determination is based on rules contained in the guideline module **208**. If the IP **320** lies outside of the gravity and measurement boundary of each guideline **330 – 350** on the page **300** or if each document object **310** does not have any guidelines **330 – 350**, then the document editing module **114** executes Step **630** and inserts the new content at the user-selected IP **320**.

If at least one guideline **330 – 350** applies to the IP **320**, then at Step **660**, the document editing module **114** determines if the IP **320** is within the gravity and measurement boundaries of multiple guidelines **330 – 350**. If the determination is positive, then the document editing module **114** implements Sub-process Select Guideline **670**, which is contained in the guideline module **208**, to select a single guideline to apply to the IP **320**. In one embodiment of the present invention, Sub-process **670** selects the guideline **330 – 350** on the basis of its relative position to the

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IP **320**. For example, Sub-process **670** can select the guideline **331** that is adjacent or closest to the IP **320**.

Sub-process **670** can apply various rules contained in the guideline module **208** to determine the dominance of one guideline relative to another. In one embodiment of the present invention, guideline hierarchy is user-selected. In another embodiment of the present invention, guideline dominance is a function of position on the page **300**. For example, a guideline that is left of the IP **320** can be dominant over a guideline that is right of the IP.

After selecting a single guideline **330 – 350** to apply to the IP **320**, the document editing module **114** moves the IP **320** from the user selected location **320** to a position **380** aligned to the selected guideline **331**. At the adjusted IP **380**, the document editing module **114** insets the new, user-entered content into the page **300**. By aligning new content with existing content **310**, the document editing module **114** enhances readability and usability of the page **300** and its content.

Exemplary Pages and Process for Organizing a Page, Figures 7A, 7B, 8

In addition to organizing content as a user is entering the content into a page, in one embodiment, the present invention can organize a page after the page contains multiple document objects with misaligned content. Figure 7A is a display image illustrating a page **700A** with four document objects that are misaligned with respect to one another prior to alignment in accordance with an exemplary embodiment of the present invention. The electronic page **700A** presents Document Objects **310, 710, 740,** and **750,** each with horizontal and vertical guidelines attached to content features relevant to content alignment. Figure 7B is a display image of the same page **700B** with the same document objects **310, 710, 740, 750** and same guidelines following alignment by an exemplary embodiment of the present invention. Figure 8 is a flow diagram illustrating an exemplary process **800** for aligning the contents of document objects with respect to one another in accordance with an exemplary embodiment of

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the present invention. Figure 8 furthermore illustrates an exemplary process **800** for organizing the content of the page **700A** presented in Figure 7A to provide the aligned format **700B** presented in Figure 7B. Process **800** is described below in reference to the exemplary pages illustrated in Figure 7A and Figure 7B.

5   Referring now to Figures 7A, 7B, and 8, at the beginning of Process **800**, a page **700A** includes multiple document objects **310**, **710**, **740**, and **750** with misaligned content, for example as illustrated in Figure 7A. At Step **810**, a user enters a request into the electronic writing tablet **200** to automatically align the content of the page **700A**. At Step **820**, the document editing module **114** engages

10   the guideline module **208** to identify the most dominant document object and the guidelines attached thereto.

      In one embodiment of the present invention, the document editing module **114** determines object dominance on the basis of position on the page **700A**. In one embodiment of the present invention, the further left a document object is positioned

15   on the page **700A**, the greater its dominance. In one embodiment of the present invention, the higher the document object is positioned on the page **700A**, the greater its dominance. In one embodiment of the present invention, a document object that is in the top, left-hand corner of the page **700A** has the greatest dominance. In another embodiment of the present invention, user preference sets forth the dominance of a

20   document object. Those skilled in the computer-based document arts appreciate that the present invention supports a variety of rules and processes for determining the alignment dominance of one document object relative to another.

      For exemplary page **700A**, the document editing module **114** identifies Document Object **310** as dominant over the other objects **710**, **740**, **750**. This

25   identification establishes the position of the content of the most dominant document object, for example Document Object **310**. At Step **830**, the document editing module **114** selects the next most dominant document object for content positioning

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relative to the most dominant object **310**. For exemplary page **700A**, the document editing module selects Document Object **710**.

At Step **840**, the document editing module **114** aligns the content of the second most dominant document object **710** with the content of the most dominant document object **310**. For exemplary page **700A**, the document editing module **114** adjusts the position of the content of Document Object **710** into alignment with the content of Document Object **310** according to the displacement of Guidelines **720** and **722** relative to Guidelines **331** and **332**. After alignment, Guidelines **720** and **722** overlay Guidelines **331** and **332** respectively, as illustrated in Figure 7B.

At Step **850**, the document editing module **114** adjusts the position of the content of the next most dominant document object, while maintaining the guideline alignment achieved in Step **840**, to avoid infringing other, more dominant document objects. In other words, at Step **850**, the document editing module **114** can fine-tune the position of the document object content that was positioned in Step **840**. For exemplary page **700B**, the document editing module **114** determines if the new, adjusted position of the content of Document Object **710** interferes with another document object. Since Figure 7B does not illustrate an interfering object, the page **700B** does not require further positional adjustment. If fine-tuning positional adjustment was needed, the document editing module **114** would adjust the horizontal position of Document Object **710**'s content while maintaining its vertical position.

At Step **860**, the document editing module **114** determines if there are additional document objects on the page with contents that need to be aligned. If the determination is positive, the document editing module **114** iterates Steps **830, 840, 850** for each document object on the page. The process ends when the content of each document object is aligned.

For exemplary page **700A**, the second processing iteration aligns the content of Document Object **740** with the contents of Document Object **310** and Document Object **710**. Moving Document Object **740**'s contents vertically overlays its

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Guidelines **742** and **744** with Document Object **310** Guidelines **337** and **338** respectively, thereby aligning Document Object **740**'s content relative to Document Object **310**'s content. Moving horizontally while keeping these guidelines **742, 744, 337, 338** in alignment facilitates the alignment of Document Object **740**'s contents

5   with respect to Document Object **710**'s content. The document editing module **114** moves Document Object **740**'s contents horizontally until Guidelines **748** and **746** overlay Guidelines **724** and **726** respectively. When Guidelines **748, 746, 724,** and **726** are in alignment, the content of Document Object **740** is positioned into alignment with the content of both Document Object **710** and Document Object **310**.

10   The third processing iteration for exemplary page **700B** aligns the content of Document Object **750** with the content of Document Object **310** by overlaying Guidelines **758** and **760** with Guidelines **340** and 341 respectively. When the third processing iteration on exemplary page **700A** is complete, the page **700B** is organized and the content is aligned as illustrated in Figure 7B. With the content presented in

15   this aligned format, a user can efficiently access information.

Conclusion

One skilled in the art would appreciate that the present invention supports aligning the content of multiple documents objects relative to one another in an

20   electronic page. An insertion point for the addition of new content can be placed on an electronic document page outside of an existing document object. In response to placing the IP on the page, a computer-implemented method can adjust the position of the IP so that the new content is aligned in relation to the existing content. When a page has several existing document objects, a computer-implemented method can

25   organize the page so that the content of each document object is aligned relative to the other document objects.

Guidelines, which provide an indication of relative displacement, can emanate from features of new and existing content that are relevant to alignment. A region of

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gravity and a measurement boundary for each guideline can determine the circumstances, such as a spatial dominion, to which a guideline applies. Rules applied to the document objects on a page can set forth the dominance, or alignment hierarchy, of each document object on the page.

5   From the foregoing, it will be appreciated that the preferred embodiment of the present invention overcomes the limitations of the prior art. From the description of the preferred embodiment, equivalents of the elements shown herein will suggest themselves to those skilled in the art, and ways of constructing other embodiments of the present invention will suggest themselves to practitioners of the art. Therefore, 10   the scope of the present invention is to be limited only by the claims below.